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Feedback

How to describe your data || - normal distribution

12th lecture

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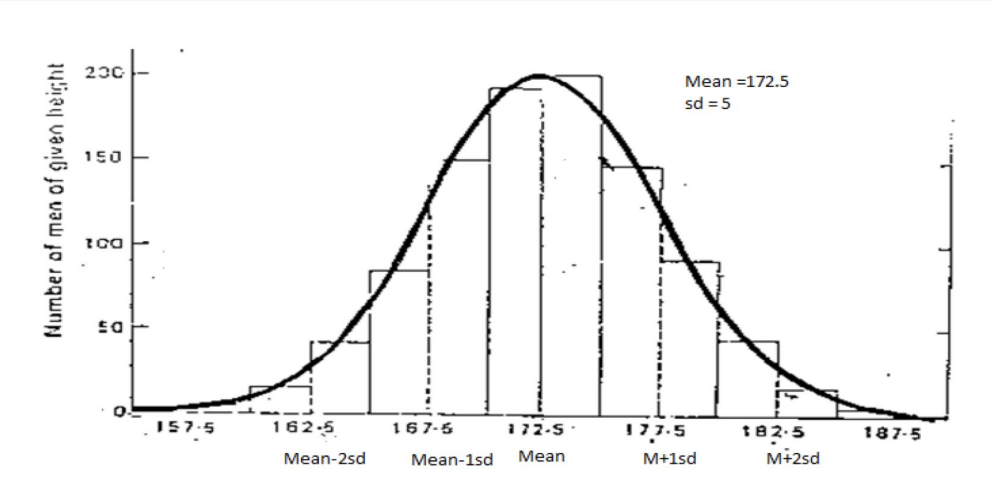
How to describe your data II

Q1

using the NORMAL curve shown below, answer the following questions: (answers will be underlined)



A. The normal curve is a bell shaped curve.
B. The total area under the curve is equal to 1 (100%) .
C. 68% of the area lies between (mean-sd) and (mean+sd).
D. 95% of the area lies between (mean-2sd) and (mean+2sd).
E. 99% of the area lies between (mean-3sd) and (mean+3sd).
F. Normal distribution can be standardized in terms of a quantity called

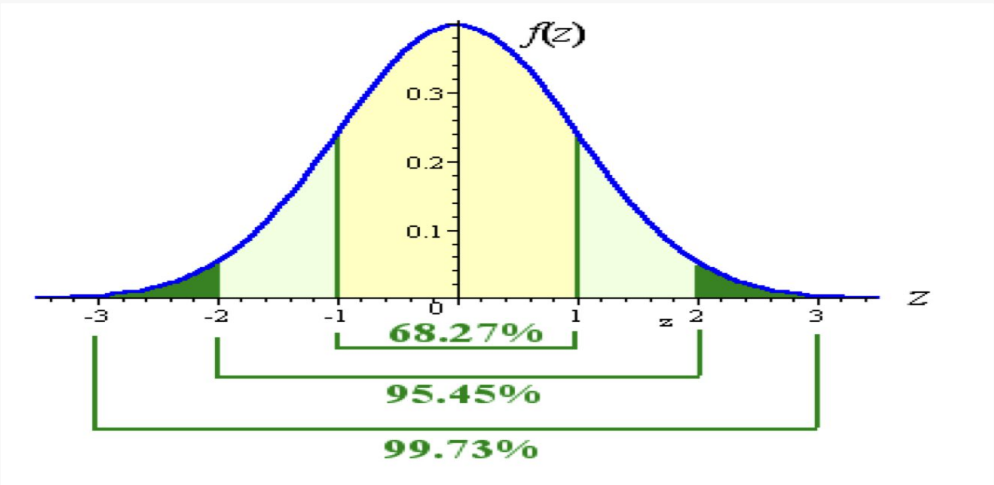
$$Z = \frac{\text{Observation - Mean}}{\text{Standard deviation}}$$

, what do you call this Z : standard normal deviate

Z is how many standard deviations are you away from the mean

Q2

standardized normal curve (mean 0 and variance 1) is shown below:



Looking at the graph, fill up the following:

A. what is the area lies between (-1 ≤ Z ≤ 1) ? 68.27%
B. what is the area lies between (-2 ≤ Z ≤ 2) ? 95.45%
C. what is the area lies between (-3 ≤ Z ≤ 3) ? 99.73%

How to describe your data II

Q3 To find the shaded area under normal curve from mean to z value 1.45 using z tables.

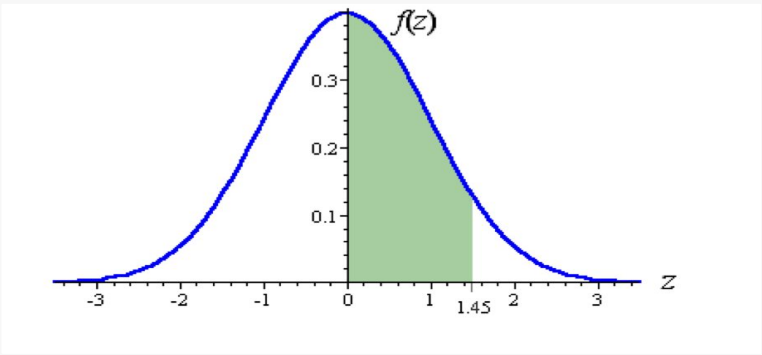


Table : Standard Normal Distribution – Area from 0 to Z value

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3304	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999

Solution: 0.4265 (42.6%)

How to describe your data II

Q4

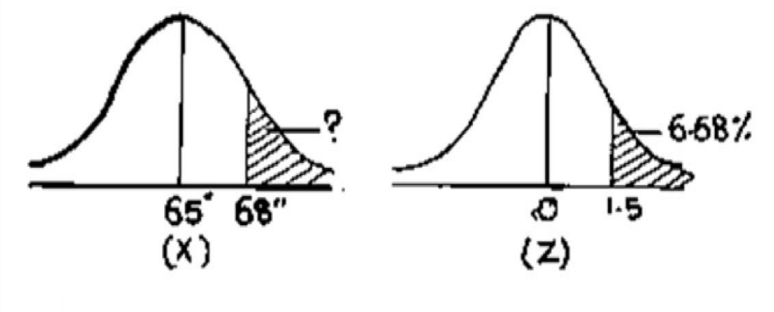
If the distribution of heights of persons in a city has mean height 65" and sd 2"

a) Find the Proportion of persons whose height exceeds 68"

ANSWER: Normal deviate = Z = (X-mean)/sd = (68-65)/2 = 1.5

The z table gives areas from 0 to z. But, now we want the area from z to infinity. This gives us proportion of persons whose height exceeds 68'.
We know the area from 0 to infinity is 0.5. so, if we subtract area of 0 to 1.5 from 0.5, we get the area from z to infinity.

Area from 1.5 to infinity = (0 to infinity) – (0 to 1.5)
= 0.5 – 0.4332
= 0.0668 = 6.68%
That is, there are nearly 7% of persons whose height exceeds 68"

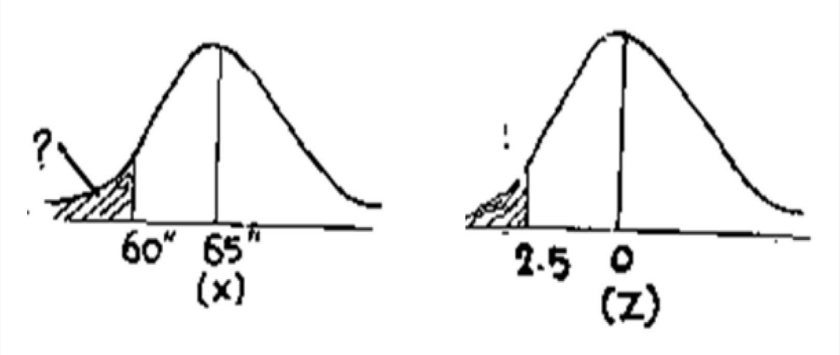


Proportion = percentage , probability = number

b) Find the proportion of persons whose height is less than 60"

ANSWER: compute Normal deviate = Z = (X-mean)/sd = (60-65)/2 = -2.5[1]

We want the area from -∞ to –2.5 because we want the proportion of persons whose height is less than 60".
The z tables give areas from 0 to z .We know the area from 0 to infinity is 0.5. So, if we subtract value of 0 to 2.5 from 0.5, we get the area from z to infinity.
Area from 2.5 to infinity = (0 to infinity) – (0 to 2.5) = 0.5 - 0.4938 = 0.0062 = 0.6%
There are nearly 0.6% of persons whose height is <60"



1. Negative go to the left direction from the mean, positive go to the right from the mean

How to describe your data II

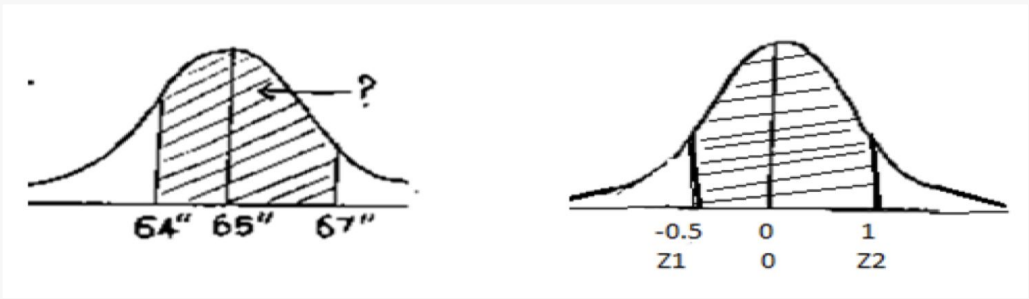
Q4

If the distribution of heights of persons in a city has mean height 65” and sd 2”

c) Proportion of persons whose height is in between 64" & 67”

ANSWER: First, find Normal deviate for 64”
Z1 = (64 – 65)/2 = -0.5
Next, find Normal deviate for 67”
Z2 = (67 – 65)/2 = 1
We want the area from -0.5 to 1
Z table gives area from 0 to z.
We know area from -0.5 to 0 is same as area from 0 to 0.5
Hence, answer to the problem is to add the areas
Area from 0 to 0.5 and from 0 to 1
Area from 0 to 0.5 = 0.1915
Area from 0 to 1 = 0.3413
Area from -0.5 to 1 = 0.5328 = 53.28%

There will be 53% of persons whose height is in between 64" & 67”



How to describe your data II

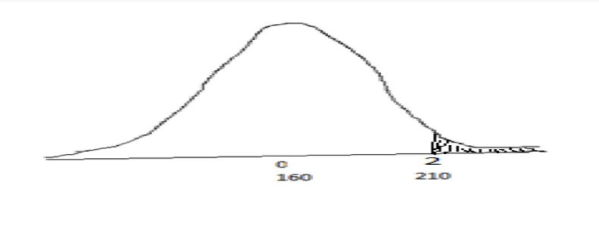
Q5 **suppose cholesterol level in a healthy population follows normal distribution with mean cholesterol = 160 mg/dl and; S.D. = 25 mg/dl**

a) What percentage of population is likely to have a level more than 210 mg/dl?

ANSWER: first we draw rough normal curve showing which area we want to find. Next, we want the area from 210 to the end. So, we find the z value corresponding to 210 mg/dl and find the area from this z to the end.

Z = (x-mean)/sd = (210-160)/25 = 50/25 = 2
Area from 2 to end = (0.5) – (area from 0 to 2) "get it from the table"
= 0.5 – 0.4772 = 0.0228 = 2.3%

2.3% population is likely to have a level more than 210 mg/dl



b) What percentage of population is likely to have a level between 110 and 210 mg/dl?

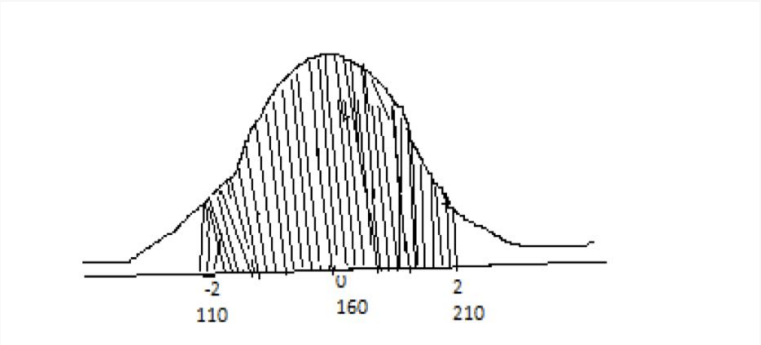
ANSWER: here also draw rough normal curve and shade the area from 110 and 210 mg/dl and then find the z values corresponding to 110 and 210 find the area from the z tables.

Let z1 = (x-mean)/sd = (110-160)/25 = -50/25 = -2
Let z2 = (x-mean)/sd = (210-160)/25 = 50/25 = 2

Area from -2 to 2 = (area from -2 to 0) + (area from 0 to 2)
Area from -2 to 0 = area 0 to 2 because of symmetry,
Area from -2 to 2 = 0.4772+0.4772
= 0.9554 = 95.54%

95.5% of the population is likely to have a level between 110 and 210 mg/dl

- **Or** in a quick way, since it is 2 SD, we know that 2SD = 95.5% (check point D Page 2)



How to describe your data II

05 **suppose cholesterol level in a healthy population follows normal distribution with mean cholesterol = 160 mg/dl and; S.D. = 25 mg/dl**

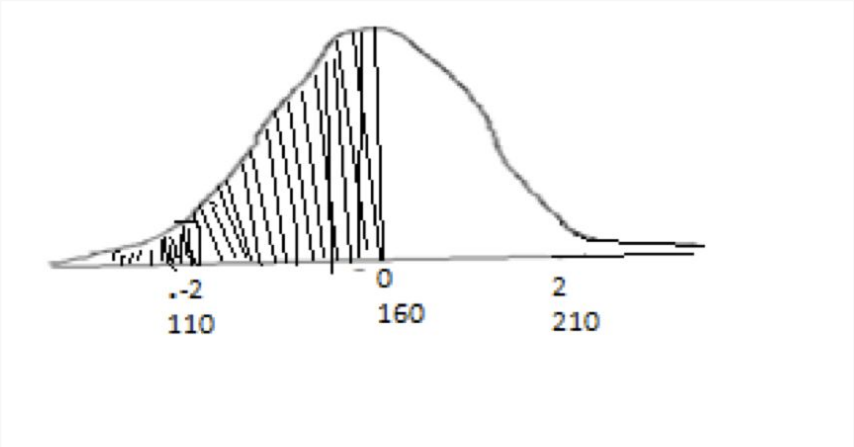
c) What percentage of population is likely to have a level below 160 mg/dl?

ANSWER: here also first draw rough normal curve and shade the area up to 160 mg/dl and find z value corresponding to 160.

Let z = (x-mean)/sd = (160-160)/25 = 0
Area up to 0 = 0.5 = 50%

50% of population is likely to have a level below 160 mg/dl.

(NB: without calculation z itself, we can tell because 50% lie below mean value 160 mg/dl)



Extra Q from Dr

suppose you have temperature reading follows normal distribution with mean 0 and; S.D. 1

A) Find the probability at < -1.5

ANSWER:

1) Z = (x-mean)/sd = (1.5-0)/1= 1.5 = 0.4332 (from table)
2) 0.5-0.4332= 0.0668

B) Find the probability at < 1.23

ANSWER:

1) Z = (x-mean)/sd = (1.23-0)/1= 1.23 =0.3907 (from table)
2) 0.5+0.3907= 0.8907

C) Find the probability at > 2.22

ANSWER:

1) Z = (x-mean)/sd = (2.22-0)/1= 2.22 =0.4868 (from table)
2) 0.5-0.4868= 0.0132

D) Find the probability at < -1.75

ANSWER:

1) Z = (x-mean)/sd = (1.75-0)/1= 1.75= 0.4599 (from table)
2) 0.5+0.4599= 0.95

E) Find the probability between -3 & -1

ANSWER:

1) Z = (x-mean)/sd = (3-0)/1= 3= 0.4987 (from table)
(1-0)/1=1 =0.3413 (from table)
2) 0.4987 - 0.3413 = 0.157

F) Find the probability between -1.25 & 1.95

ANSWER:

1) Z = (x-mean)/sd = (1.25-0)/1= 1.25 =0.3944 (from table)
(1.95-0)/1 =1.95= 0.4744 (from table)
2) 0.3944 + 0.4744 = 0.8688

Research Team

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438
Keep it simple, Keep it focused

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